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TACOMA MUNICIPAL POWER PLANT

BY LLEWELLYN EVANS

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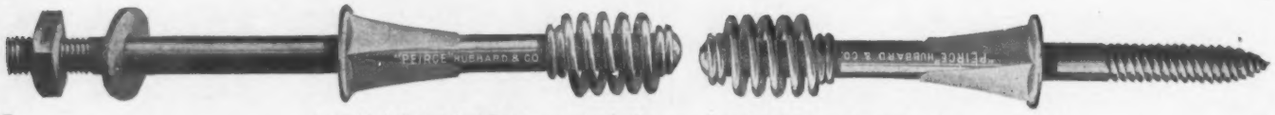

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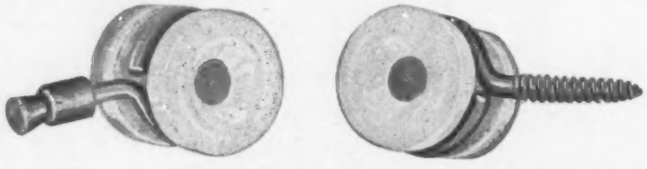

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TACOMA MUNICIPAL POWER PLANT

BY LLEWELLYN EVANS.

The City of Tacoma has just completed and put into operation on November 15th a new power plant. A birds-eye view of this development and surroundings, looking from the south to the north, would show in the east foreground Mount Tacoma with the Nisqually River flowing from under its glacier in a northwestern direction; in the middle foreground, as the stream enters a steep-sided canyon and makes a bend, a low dam, gate and keepers' houses of stone and brick with a part of the stream diverting into the mouth of a tunnel entering the rocky bluff; in the middle of the picture this tunnel bursting through the sheer walls of the canyon at the end of the bend and a pipe line continuing its course on a steel bridge across the canyon, burrowing through the soil a short space and emptying its contents into a rectangular reservoir with gate houses perched on its walls, thence five steel pressure pipes leading down into the bottom of the canyon to a brick and concrete power house, issuing from behind which are six aluminum wires tracing with bright lines a path through the firs for ten miles to the northwest and thence twenty miles north across a level prairie beside a country road, to be lost in the background in the checkerboard of the city of Tacoma.

Penstock Pipes at the Power House.

For the purpose of letting contracts the complete project was divided into sections, the first of which included the erection of the intake dam, gate houses, gates, settling channel and the 11,000 ft. tunnel through solid rock.

Dam and Headworks.

The dam is built of reinforced concrete and spans the river between solid rocks. A passageway is left inside in lieu of a bridge. This is necessary because the railroad is on the opposite side of the river from the intake. Light and air are admitted to the passage way through openings left on the down stream side. The length of the dam is 260 ft. and the height 40 ft.

For the purpose of cleaning out the sand double gates, operated with motors protected with suitable housing, are provided. These gates are 8 ft. square and are made of steel and slide in close fitting guides. Two screws, driven by one 50 horsepower motor, raise the gates. The main gates admitting the water through a 1000 ft. settling channel into the tunnel are of similar construction.

All of the buildings about the headworks, including the gate keeper's house and the gate houses, are built with stone as high as the windows and have clinker brick walls and green tile roofs.

Tunnel.

The tunnel, practically 11,000 ft. long, is straight from end to end and cut through the solid rock with a width of 8 ft. 6 in. and a ceiling height of 10 ft. 6 in. The sides and floor have been lined throughout with concrete and the ceiling has been left of rock except at places where the ground is loose. The fall in the tunnel is just sufficient to maintain the flow.

Cutting through the rock occupied about two years and during the best part of the progress 9 ft. per day was cut out from each working face. The muck was removed by electric trams. Very little water was encountered until about half way through, and then not sufficient to delay the work greatly. The rock removed was suitable, after being crushed, for concrete footings and floors, but was not the best for the reinforced concrete work.

At the north end of the tunnel the canyon is 373 ft. deep, and has practically vertical walls. The tunnel is continued across this canyon by means of a steel cantilever bridge. This bridge has a span of 200 ft. and carries a 10 ft. diameter steel pressure pipe, connected through a concrete section to the tunnel. The pipe line is 400 ft. long and is provided with three expansion joints and has manholes at both ends. A walkway with rail is built on both sides of the pipe line.

Reservoir.

From the pipe line on the bridge the water flows into an underground reinforced concrete conduit 8 ft. 6 in. by 10 ft. for one thousand feet into an open reservoir 560 by 500 ft. with reinforced concrete walls 22 ft. high and cement floor. The water is admitted to the reservoir over a spill-wall 400 ft. long. In case of too much water two waste gates 6 ft. by 6 ft. are provided, which allow the water to flow on past the reservoir and down over the canyon walls through a flume. At the waste and by-pass gate house are located gates admitting water to two conduits 4 ft. by 4 ft. 6 in. under the reservoir to the forebay gate house, providing a source of supply for the generators while the reservoir is being washed out. The wash out gates are provided on the low side of the reservoir, through which the sand and mud may be flushed, partly by water flowing over the spillway wall and by water from a hose connected with hydrants located around the reservoir. The forebay gate house is the largest of the gate houses shown in the picture. During the wash out process muddy water is prevented from entering the pipes by a weir wall about 3 ft. high, separating the reservoir and the entrance to the penstocks, and likewise this prevents water through the by-pass conduits returning to the reservoir. The gates are lifted with double screws operated by a single 40 horsepower, slip ring, induction motor set vertically. Current is supplied to all the gate houses by a 6600 volt transmission line from the power house. Transformers with protection devices are placed in the waste and by-pass gate house. All the gate motors are operated with hand controllers except those at the forebay which close the penstocks. These have remote control panels so that these gate motors can be started either from the power house switchboard or the gate houses. The reservoir has a capacity of 3,020,000 cu. ft. The walls are built in sections, dove-tailed together and calked. The floor is also laid in sections, the edges of which rest on a checkerboard of concrete beams. The floor is calked with oakum and tar at the seams.

Pressure Pipes.

There are four large pressure pipes, one for each unit, tapering from 72 in. in diameter at the top to 61 in. at the power house. Also an exciter pipe line with a lower diameter of 24 in. The pipe line pitches down the hill on a 62 per cent grade and the pipes are supported at 8 points by concrete piers for anchors. Footings on solid rock were obtained on the lower four piers. The upper piers rest on hard-pan or blue clay. The flanges on the pipes anchor them to the piers except on the upper half where a clearance has been left to allow the pier to slip without carrying away the pipe in case the footings prove

La Grande Washington, showing the reservoir, Tacoma Eastern Railway in the foreground; By-Pass Gate House at the right; Wash Out Gate House near the center and Fore Bay Gate House at the center. From the Fore Bay Gate House the water is carried in steel penstocks to the Power House 425 ft. below. The canyon walls can just be seen beyond the Fore Bay Gate House.

Pipe Line Crossing Canyon on Suspension Support.

shifty. At the intake of these penstocks a 12 in. by-pass pipe is provided with two inlet valves and an opening into each penstock, and the exciter line.

Excavating for the erection of these pressure pipe lines was the most troublesome part of the construction, inasmuch as the power house was being built at the same time and had to be protected from rolling rocks and from blasts. The larger part of the dirt was taken out by water and much of the rock removed by the blasts and transported by gravity cars. The power house was protected by leaving a thin wall of rock next to the same until the last, and removing all dirt above it through a tunnel.

Power House.

The power house is constructed with a concrete foundation, reinforced concrete floors, clinker brick walls, steel roof trusses, plank and tin roof, all designed in architectural harmony. The generating floor is about 24 ft. above the normal flow of the river. The building might be described as a series

View of the generator room from the crane basket showing two of the four units and the exciters, switchboard gallery at the right with telephone booth and report desk at the end.

of houses built in place one behind the other, first the generating building, second the transformer building and third the high tension wiring and switching building. Below the generator room floor is a basement allowing access to the butterfly valves in the penstocks and wiring for the generators. The tail race, 15 ft. wide and 13 ft. high, passes under the middle of this basement. The generator room is provided with a 35-ton alternating current crane. Three of the walls have as many windows as can be accommodated. The 40-foot ceiling makes a very light room for the machinery.

The switchboard gallery on the up-hill side half way up commands the entire floor space. The transformer house is similarly constructed, with a 10-ton crane, similar high ceilings, but less floor space, the building being narrowed down behind the generator room to admit of the pressure pipes passing on each side. The high tension building has a 35 ft. ceiling and floor space 70 x 44.

Equipment of Power House.

The penstocks connect to the spiral casing of 8000 horsepower, single discharge, Francis, inward flow, reaction type, Allis-Chalmers turbines on horizontal shaft, direct connected to 5000 kw., 6600 volt, 3-phase, 60 cycles, 450 r.p.m. generators made by the same company. Four such units are in place. The exciter pressure lines are connected to two 125 volt exciter units driven by Pelton water wheels. Each turbine is equipped with 48 in. motor-driven butterfly valve, pressure regulator with release valve, oil pressure governor, auxiliary hand control and tachometers. The single discharge feature of these wheels save 25 per cent of the floor space originally provided in the plant and allowed a corresponding reduction in the size of the power house. All generating equipment is connected with the low tension bus with lead encased, varnished cambric insulated cables. The exciter bus is located in the basement and the alternating current low tension bus behind the generator room in the basement of the transformer building. Each generator is connected through a non-automatic solenoid operated oil switch.

The station is designed so that two units may be operated separately from the other two or may be tied together by a tie switch located between the generator switches.

The transformers, twelve in number, made up of four banks of three single-phase transformers, are fed from the main bus with disconnecting switches and remote control oil switches. The wires from the high tension side of the transformers pass through special wall bushings through the 60,000 volt oil switches to the high tension bus which is divided into two halves by a tie switch. The two out-going lines can be supplied from any generator through any bank of transformers, or any two generators can be connected with either pair of banks of transformers and their current delivered to either line.

The switchboard is divided by a central column into two sections containing two generator panels, two transformer panels and one line panel each. All switches are remote controlled with drum switches on this board. A constant voltage is maintained by a Tirrel regulator provided with two groups of ten relay contacts for each exciter. Each generator panel is provided with a graphic wattmeter, integrating power factor meter and three ammeters. But one voltmeter is provided for all generators. Plugs on each generator panel connect to the synchroscope and voltmeter.

In addition to the graphic wattmeters on the generator panels there is provided a graphic frequency meter, two power factor meters and voltmeter. Each transformer panel is provided with three ammeters and each line panel with three ammeters and an integrating wattmeter. All this equipment is mounted on beveled blue Vermont marble slabs and the entire board is lighted with special Frink reflectors with ground glass diffusers. In addition to the

drum switch controllers for oil switches there are also provided controllers for the butterfly gate motors and governor motors. The complete remote control provided makes it possible to operate the station with one oiler and a switchboard operator.

Four banks of three transformers each, with a total of 5000 kw. capacity, are connected in star both primary and secondary, and are protected from discharge during switching and shorts or trouble by lightning arresters located between the banks. These are connected from the low tension side and are of the aluminum cell type. The transformers are cooled with water from the pressure pipes.

Lightning "catchers" are provided for each line. The cut shows four tanks and transfer switch at the right. The tanks contain a stack of aluminum trays filled with a caustic electrolyte immersed in oil. The cells are charged two in series by swinging the horns close together with the transfer switch, which is grounded first right and then left, a ripping arc occurring at the horns.

The oil system consists of two tanks for transformer oil and two for switch oil, with rotary pumps for filling the tanks. A vacuum pump is provided with connections to the top of the transformer to maintain a slight vacuum to carry off the moisture. The transformers set in the large, airy room above described are surrounded with a rim of concrete about 6 in. high to keep any oil or water from getting out into the room. The space is drained to the river.

In the high tension room is provided a three-pole oil switch for each transformer bank, for each high tension line and for a tie between lines. Disconnecting switches are provided for the oil switches and arresters.

Transmission Line.

Cedar poles, many of which were cut on the right of way, are used throughout. For about the first ten miles there is a double transmission line of three wires arranged on a triangle with six foot spacing, but for the remainder of the way, due to right of way arrangements, it was necessary to carry both lines on the same pole, the arrangement being to support the same on the ends of three crossarms with six foot centers. With the 45 ft. poles used there would ordinarily be small clearance, but the ground traversed is level prairie. Upright insulators on cast iron pins are bolted to the crossarms with four ⅜ bolts. Stranded aluminum cable, equivalent to No. 2/0 copper wire, is tied to the insulators with No. 6 solid aluminum ties. There is one specially long span across the Mashel River, where "A" structures, mounting a multiple row of standard insulators, carry copper cables.

Substation.

At the substation in Tacoma, shown in the cut, the high tension equipment at the power house is duplicated. Only two banks of transformers are now in place. The control switchboard is provided with drum switches for controlling each transformer switch and each line switch. Graphic meters record voltage, power, frequency and power factor.

The main bus wall is made of pressed brick with reinforced concrete shelving and supports a duplicate bus which at the heaviest part is made up of six 4 in. by ¼ in. laminated copper busses.

Taps are taken off through fibre bushings to disconnecting switches on the opposite side of the wall. The compartments containing the taps and disconnecting switches are shown at the left of the picture showing the lighting switches. The low tension pressure in the station is 4000 volts between busses and 2300 to ground. A three-phase, four-wire distributing system is used throughout the city.

The interior view of the substation shows the arc lighting panels on the left, the main control board in the center, power distributing panels at the right and lighting distributing panels in front of the regulators. The special features connected with the arc lighting panels are the cement barriers and supports, one of which is shown in the picture.

Interior of substation; Arc Board at the right; Main Control Board center; Light and Power Panels right; Transformers and High Tension Wiring rear.

The wires leading from the oil switches on these panels are carried to the floor below in fibre ducts cast in these barriers. On the ceiling under the switchboard the wires are carried in one-inch fibre conduit with appropriate fittings, and follow down some brick columns and along brick walls to the arc tubs on the floor below. These wiring features were all worked out in detail in the engineers' drawings and were executed to make a very neat appearing job. Provisions the made for 50 arc circuits and spare room left for as many more.

The lighting panels, five in number, control one 4-wire circuit each. Drum controllers operate each pole of the oil switches separately. On each feeder single-phase current regulators controlled by primary and secondary relays maintain constant voltage at any pre-determined point in the line. Each panel of the lighting switchboard mounts three ammeters, three voltmeters, three primary and secondary regulating relays, integrating wattmeter, graphic recording wattmeter, two overload relays, and four drum controller switches with their indicating lamps. The wiring for these various instruments and equipments is mounted on cleats, in places, seven wires wide and three deep. Connecting up these panels, together with the regulators and remote controlled switches cost about $150 per panel for labor, but elegant results were obtained.

Power circuits are provided with a similar switchboard except that the regulators are omitted. Control current for all the solenoid operated switches and indicating lamps is furnished by a 135 volt storage battery with a 5 kw. charging set.

The most noticeable feature of this station to the visitor is its wide stairway, white tile wainscotes, high ceilings and generous lighting. The station is unusually roomy. All cables leaving the station go out underground through tunnels under the basement floor. At the present time these underground circuits are carried from the manholes in the street nearby up to overhead wood pole lines.

Cost of Construction.

All of the above described project has been completed, including the cost of rights and legal arrangements and the cost of selling the bonds, for practically $2,500,000. The station has a capacity in the size of tunnel, reservoir, pipe lines, generating equipment, transmission line, and substation for a normal load of 20,000 kw. This would make an overall cost per kw. of equipment, including the substation, of $125. By omitting the costs of rights and substation a much lower cost per kw. could be figured out for comparing with similar projects.

The main secret of such low cost of construction is due to the fact that all the work was done by contract, and in all there were not less than fifteen contractors and sub-contractors, each doing his own specialty in the construction of the various parts of the plant. Large credit may be also given to the fact that the plans were gotten out complete with details to the last hexagonal nut of every part of the work before contracts were let. The contract for the tunnel having been let first, the engineers had practically two years for the completion of accurately detailed plans for the remainder. There might also be some credit due to the fact that there were three different project engineers connected with the work:

Frank C. Kelsey started the work and laid down the broad lines on which the project was based. During his time the hydraulic features of the headworks and tunnel were completed and the remainder of the work well outlined. He was criticized some for his extravagance in design, so that when his successor, Hamilton F. Gronen, took charge of the work there was opportunity for econimies before the balance of the contracts were let. These were effected, not so much at the expense of permanency, as with the selection of standard apparatus and new designs in place of special designs. The work was completed by Herman Keith, who has a reputation as a construction engineer.

The Tacoma Eastern Railroad passes with the reservoir power house and the head works, and was a large factor in making a low cost of construction.

It may be said that the personal interest of each city official engineer, contractor and workman added to the success of the project and accounts in a large measure for the excellent work and low cost. The usual municipal project has a similar history in the matter of changes in organization but not many seem to have worked to the good of the public, instead of to its detriment.

It is hoped by the well-wishers of the municipal plant in Tacoma that the theoretically certain failure, due to lack of continuity of purpose, will not befall this plant, as it has many other municipal undertakings. The city maintains and owns its own distributing system for light and power and has by ordinance a monopoly on the electric lighting business of the city. It has, however, competition in the matter of power. The rates for lighting range from a 6c to a 3c minimum on a sliding scale according to quantity used in a month. Power rates vary from 2.4c maximum to .72c minimum on a sliding scale according to the customer's load factor. While the city cannot sell as much power current as her competitors she will at least govern the maximum cost for some time to come.

Summing up the situation, the city has purchased for a low cost per kilowatt a power plant having permanent concrete dam and headworks equipment, a conductor for water cut through the solid rock which will not deteriorate, a concrete reservoir, heavy short steel penstocks, the newest and most approved and tried machinery installed in permanent fireproof buildings and the transmission line on a wide right of way with a few danger points. It is estimated that this installation can be operated at a minimum cost for labor and practically negligible up-keep. With this it is hoped that the citizens of Tacoma have protected themselves against high power rates and have established an enticement for manufactories.

The responsibility of first putting the electrical equipment into service, and adjusting the troubles that are sure to appear at that time, was taken care of by Tacoma engineers, Evans-Dickson Company, who were sub-contractors on erection of the detail electrical equipment. The writer had the pleasure of personally supervising the work, and hopes to later write an account of these starting up experiences.

STREET-LIGHTING METHODS IN ARABIA.

BY CONSUL WALTER H. SCHULZ, ADEN.

The streets and buildings of Aden and all important towns of this consular district are lighted by means of kerosene lamps, the only exception being three private electric plants at Aden maintained by the Peninsular & Oriental Steam Navigation Company, the Eastern Telegraph Company and the Residency (the governor's residence), and a few gasoline burners used in some of the larger stores. The local authorities on several occasions have inquired into the feasibility of providing more modern lighting methods, but obstacles have always been encountered.

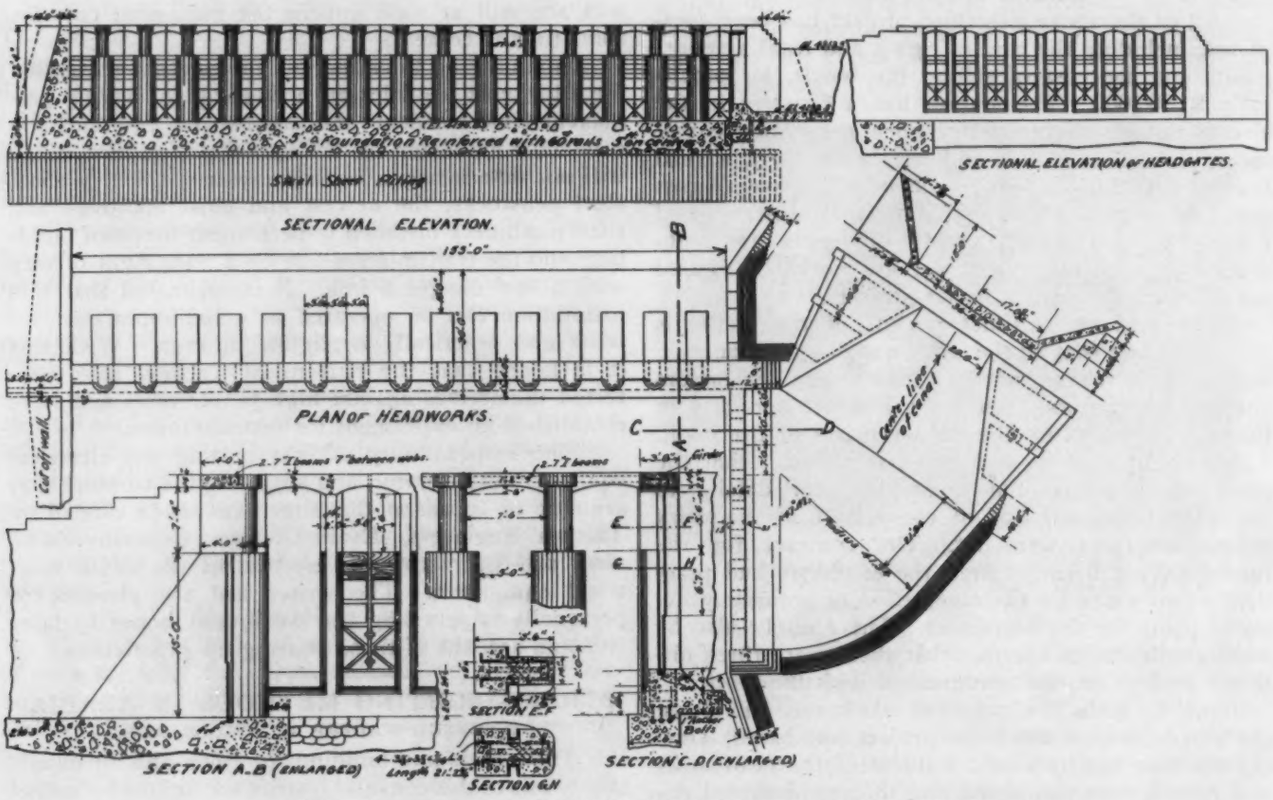
Keresone being the universal illuminant in this part of the world, there are a large number of oil lamps competing in this market, among which the German, English and Austrian articles predominate. Successful American competition, therefor, is a matter of doubt. Of course only Europeans and natives of the better classes are in a position to buy lamps. The native of the coolie type is content with a tin container of a gill capacity and which, together with a slender wick, costs him about 1 cent. It yields a dim and flickering light, but answers fully the needs of his humble home.

ELECTRICAL PUMPING AND IRRIGATION

DETAILS OF HEADGATES.

BY B. A. ETCHEVERRY,

The make-up and detailed design of the regulator at the head of a main canal may be illustrated by two very different types of diversion works: the headworks of the Truckee Carson project on the Truckee River and the headworks of the Yakima Sunnyside project on the Yakima River. These works are shown in the accompanying plans supplemented with a general description and cost data.



Diversion Dam and Headgates—Truckee-Carson Project, Nevada.

Headworks of Truckee-Carson project.

The headworks of the Truckee-Carson project on the Truckee River consist of an open diversion weir and canal headgate or regulator at right angles to the diversion weir, built in one structure. The diversion weir is 155 ft. long and consists of 15 piers placed 10 ft. on centers; between the piers and abutments are 16 gates. The piers rest on a concrete foundation 8 ft. thick and 30 ft. wide reinforced with 60 lb. rails, spaced 5 ft. on centers in both directions. Sheet steel piling 12 ft. long was driven 2 ft. from the upstream face of the foundation floor for a distance of 185 ft. These piles extend well in the bed of the stream which is composed of gravel, boulders and sand. Beyond the concrete foundation a paving of large stones extends 30 ft. down stream; the thickness of the paving is 5 ft. at the upper end and 2 ft. at the lower end. The piers are walls 15 ft. high, 6 ft. 3 in. wide at the top and 18 ft. wide at the bottom; the thickness is 5 ft. These walls are not reinforced and are designed as gravity walls. On top of these piers are smaller piers on which rest the operating platform. The operating platform is arched and reinforced with I beams well anchored to the piers to resist the upward pressure when forcing the gates closed.

The gates consist of cast iron gates each 5 ft. high and a set of flashboards for the upper 5 ft. When the lower gate is raised 4¾ ft. it catches the second cast iron gate and both are raised together. The flashboards are 3 in. x 12 ft. x 5 ft. 8½ in. The total height of opening can be 15 ft. The advantage of having the gate in sections is that it does not require a lifting force to raise them as large as if they were in one piece. To reduce friction all bearing surfaces are machine faced. The lifting stand is of cast iron with bevel-gearing operated by a hand screw. The headgates consist of 9 gates 5 ft. wide. The posts between gates are 7 ft. center to center and 2 ft. thick. For sluicing the silt and sand past the headgates, the sill of the headgates is made 3 2/3 ft. above the floor of the weir. The concrete floor has an average thickness of 2 ft. The floor at the sill is 6 ft. thick with a cut off wall in front extending down into the stream bed.

The headgates differ from the weir in that instead of piers of plain concrete the posts are made of concrete reinforced with built-up steel girders which allow of much lighter construction. The posts are de-

signed as beams. About two-thirds of the water pressure is transmitted to the floor and about one-third to the operating platform, which is also reinforced with a built up steel girder to resist this pressure. The gates are similar to those of the weir except that there are only two flashboards instead of five, and the total height of the gates is 11 ft. 4 in.

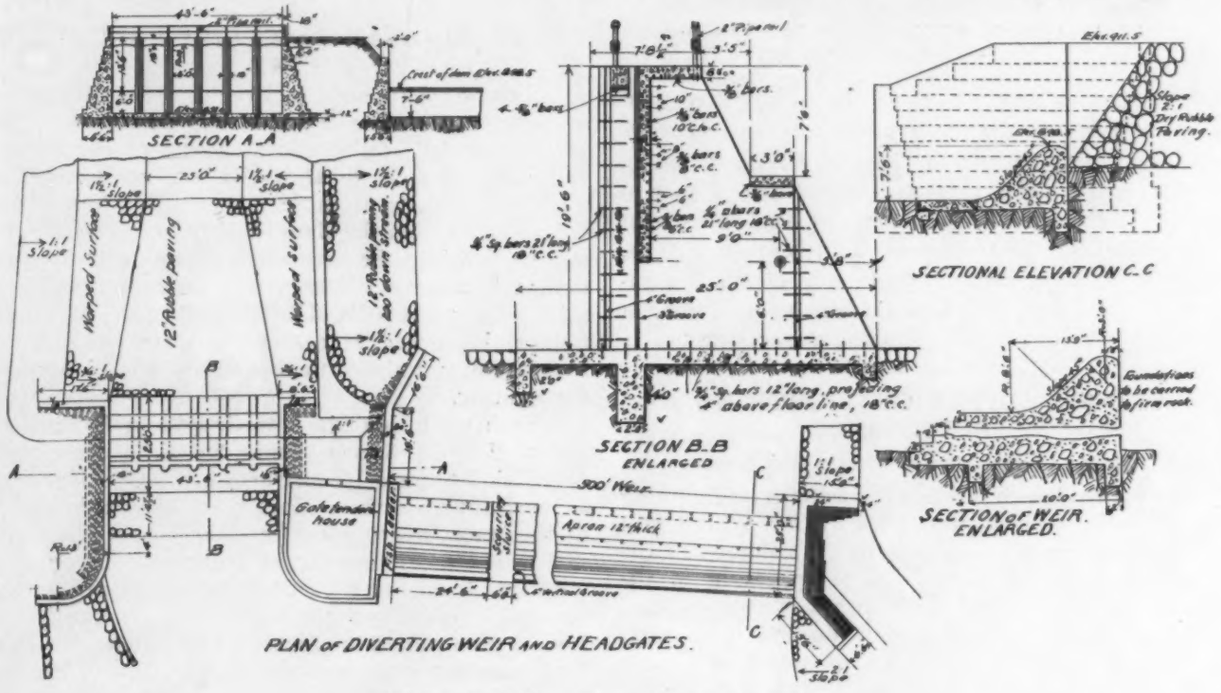
Beyond the headgate is an overflow spillway with its crest 13 ft. above the bottom of the canal intended for close control of the water if too much water is admitted to the canal.

The total cost of these headworks was $85,390 distributed about as follows:

Cement, 3971 barrels at $2.95	$10,126
Excavation	13,397
Concrete, 3322 cubic yards	19,932
Sheet piling	5,365
Gates, guides, stands, etc.	12,129
Riprap	13,548
Temporary flume	2,373
Steel girders, lumber, puddling	8,520
	$85,390

tinued beyond the 20 ft. with a series of steps 1 foot 6 in. wide and 1 ft. high. Cut off walls 2 ft. wide extend 1 ft. into solid rock at the upstream toe of the weir and at the lower end of the apron. The crest of the weir is 6½ ft. above the sill of the headgates, which assures that depth of water through the gates when the water just overflows over the weir.

The headgate is 43 ft. 6 in. wide and 19 ft. 6 in. high. The top of the operating platform is at the same height as the top of the earth embankment beyond the end of the diversion weir. The headgate consists of six gate openings 6 ft. high and 6 ft. wide, separated by buttress walls 18 in. thick. Between the buttress walls above the gate opening are panel walls 8¼ in. thick reinforced with ⅜ in. square bars. This panel wall takes the pressure of the water above the gate openings so that the pressure on the gate is much less than it would be if the entire space between the buttresses was open and had to be closed with



Headwork—Yakima-Sunnyside Project, Wash.

Headworks of Yakima-Sunnyside project, Washington.

The diversion weir is a closed weir of the Ogee type. The headgates are separated from the weir by the gate tender's house. About 25 ft. away from the gate tender's house is a scouring sluice 6 ft. wide, which for a stream carrying much silt would not be sufficient. It would also be preferable to have the scouring sluices nearer the headgates.

The weir is 500 ft. long and rests on rock. The cross-section of the weir is commonly known as the Ogee type and consists of a curved crest and a curved lower face continued with an apron 1 ft. thick. The width of the weir from the upstream face to the end of apron is 20 ft. The height of the crest above the apron is 7½ ft. The crest is curved with a 3 ft. radius while the lower curve as an 8½ ft. radius. In the deeper portions of the stream where the crest is more than 7½ ft. above the bed of the river, the apron is con-

gates extending to the top of the platform. The panel wall is also necessary to prevent water from overtopping the gate during flood flow.

The operating platform is 8 in. thick and is reinforced with ⅜ in. steel square bars placed 6 in. on center 1½ in. from bottom of slab. The gates are vertical cast iron gates with 3½ in. gate stems. They slide in metal grooves placed in the buttress wall and are lifted by cast iron stands with beveled gear operated by hand.

Below the cast iron gates is another set of wooden gates of the Taintor type, which are radial gates hinged 6 ft. above the floor and 9 ft. from the outside face of the panel wall. These gates are emergency gates to be used when it is necessary to close the gates rapidly, as they can be dropped very quickly. The emergency gates would very seldom be used.

The dam was built of rubble concrete composed

of large stones, which could be handled by one man, incorporated in the concrete. The proportion used was 43 per cent rubble stone and 57 per cent concrete. Eighteen hundred and nine cu. yds. of rubble concrete were put in the dam at an average cost of $6.40 per cu. yd. excluding engineering and administration. For the headgates, 493 yds. of concrete were put in for

Finished Appearance of Headworks—Truckee-Carson Project, Nevada.

the foundations and wings at an average cost of $13.95 and 38 yds. for the buttress walls, panel walls and platform at an average cost of $28.70, including reinforcement. The cast iron gates cost $2,529 in place. The concrete work for the headworks cost nearly $20,000. Excavation for abutments and dams, building of dyke, widening of river channel, excavating main canal, etc., brought up the total cost of the headworks to $48,531, including administration.

LETTER TO EDITOR ON LIGHTNING ARRESTERS.

Editor Journal of Electricity, Power and Gas:

I have read with interest the articles on lightning protection for transmission lines by Mr. Alfred Still which have recently appeared in the columns of the Journal. Referring to the article appearing in the Journal of Feb. 1, 1913, wish to ask if you know of any experiments having been made and if so what success was attained in the use of a section of iron pipe through which a single wire of a high tension transmission line was passed with the idea of using it in the place of a choke coil? It occurs to me that such an arrangement could be made which would offer a proper choking effect and yet not have sufficient inductance to impede the flow of the ordinary line current at the normal operating voltage and frequency. If this were practicable it would be a much simpler and much cheaper form of choking device than the ordinary choke coil for lines upon which a voltage of say 50,000 or 60,000 volts were carried.

I would thank you for any opinion which you may have on the subject.

Yours truly,

THE NEVADA-CALIFORNIA POWER CO.,

Geo. M. Wills, District Manager.

Reply.

Attempts to increase the flux of induction by providing choke coils with iron cores, or passing a single conductor through an iron tube in the manner you suggest, do not lead to satisfactory results when dealing with very high frequency currents. The effect of hysteresis, by causing the changes in the magnetic flux to lag behind the changes in the current, alters the phase relations between the current and the induced volts; and, for dealing with sudden impulses of energy, or high frequency oscillations, a coil with iron core (or the proposed equivalent) would not be so effective as a coil without iron core which, under normal conditions, would have the same inductance.

I do not know if practical experiments have been made with the arrangement you suggest; but on so high a voltage as 50,000 or 60,000, the current would be comparatively small, and, since the cost of the choke coil will be largely in the terminals and insulating supports, it is doubtful if any appreciable economy would be effected by departing from standard practice.

ALFRED STILL.

Purdue University, LaFayette, Ind., Feb. 13, 1913.

TRANS-ISTHMIAN ELECTRIC TRANSMISSION LINE.

Survey began early in December for the location of towers to carry the electrical transmission line which will follow the relocated line of the Panama Railroad from Cristobal to Balboa, connecting terminal substations at those points. The line will be fed normally from the Gatun hydroelectric station, and will be tied into the permanent steam-generating station at Miraflores. Energy will be transmitted along this line at a potential of 44,000 volts, in delta connection, and reduced at centers of distribution to the requisite potentials for the operation of machinery and for lighting.

Each tower is to be a track-span bridge, consisting of two side frames connected by a cross-bridge all of skeleton steel construction. The bridge is to support duplicate three-phase lines, one on either side of the track, a ground wire strung from the top of each side frame, messengers and cables for duplicate telephone trunks and for track signal circuits, and the necessary messengers and wires for a catenary trolley construction should the Panama Railroad be electrified. Under the specifications being prepared, preliminary to advertising for bids on furnishing materials for the line, 725 single-track and 100 double-track bridges will be required, with 2,000,000 ft. of copper wire, No. 00, B. & S. gauge, 6500 three-unit suspension insulators, and 1000 ground plates. Inasmuch as the commission has secured poor deliveries upon recent requirements of structural steel fabrications, in connection with unfavorable prices on both steel and copper in the United States market, foreign manufacturers will be invited to compete for furnishing materials for the transmission line.

CONCRETE AT PANAMA.

Over 95 per cent of the total of 4,446,530 cubic yards of concrete to be placed in the locks had been laid at the close of work on January 18, the amount in place being 4,245,472 cubic yards. Over 94 per cent of the concrete for the system of three twin locks at Gatun has been laid, the amount in place at the close of work on January 18 being 1,929,306 cubic yards, out of a total of 2,043,730.

READINESS TO SERVE METHODS

COSTS OF ELECTRICALLY OPERATED FARM VEHICLES.

BY ROSS B. MATEER.

General consideration of the transportation problem does not limit the range to the "steel road" or tram car but includes within its scope, every application of mechanical power wherein a comparison is possible with the horse and his ability to perform work. In the city, the conveying of humanity or merchandise from one point to another is a problem presenting but two phases, the distance covered and the number of stops per unit distance traveled, while in the country the time element becomes a factor of prime importance, as the acreage cultivated increases. Formerly, the farmer trudged many miles patiently following his horse and plough, turning over an acre of soil each day. Today the gas tractor, requiring the attention of one man, accomplishes the same amount of work in thirty minutes. And where large acreage permits of the use of three tractors, hauling fifty ploughs, an acre can be turned over in 4¼ minutes.

Consider if you will, the cost per acre with the horse as $4, and with a gas tractor of only $1.60 per acre. The cost, per acre, ploughed, with the electrically operated plough, will, in the near future, be further reduced by reason of increased efficiency of prime mover and the rapidly decreasing cost of electric energy.

The necessity for the development of electric ploughing is evident when the turning over of five square miles means a distance traveled of 25,000 miles or a single furrow around the earth. Time element and cost per acre demand the solution of the problem of tilling the soil on an electrical basis and enroll it as a transportation problem of first importance.

Electrically Operated Portable Thresher.

The "Utility Truck."

Grass must be watered and it is not always convenient to install a number of pumping outfits, as certain portions of a given acreage may be flooded on successive days. The solution for this problem is a portable motor-operated pumping equipment, not mounted on skids but on its own truck, electrically propelled. The advantages of such an outfit are evident, suffice it to say, that the same motor used for pumping may be belted to the thresher and separate the grain from the chaff.

Threshing Grain.

Alfalfa when cut must be carried to the barn, or if baled on a requisition, delivered to the railway, often a considerable distance from the field and farms. Horse-drawn vehicles have been used and found unsatisfactory by reason of (a) maximum operating expense, (b) limited distance traveled, (c) limit to tonnage carried, (d) maintenance.

The four reasons above stated are those occurring frequently in an effort to obtain an idea of the transportation problem and its effect on the hauling of alfalfa, hay or grain from the field to markets, and indicates clearly, the large field for electric vehicles that are (a) prompt in action, (b) creditable in appearance and (c) suitable for the work required of them.

Where the time element in carrying grain to the thresher, by reason of variable weather conditions, is important, the electric vehicle is a valuable addition to the farm equipment. Again, with an electric truck, farms which are distant from the railroad, can be purchased at reasonable figures and made as valuable, if not more so, than those farm lands contiguous to the city. Such farms, once termed remote, are

Fig. 3. Electric Truck in Harvest Field.

no longer so as their proximity is measured not by miles, but by hours and ability to quickly deliver the crop at the nearest railway station or boat landing.

The same truck that is used for delivering produce or dairy products at the terminal points may be advantageously operated in the harvest field performing nearly the same amount of work accomplished by three two horse wagons.

A 3½ ton electric truck loaded with 617 bundles of grain yielded 45 bushels of wheat, while the maximum load in bundles on the regular wagon was only 260, demonstrating the superior carrying capacity of the electric vehicle.

Mountain or plain, gravel or sand, wet or dry roadways have no terrors for the electric truck which experience demonstrates travel a greater distance per unit cost of energy than those operated by horse or gasoline engine.

In the Scientific American, Mr. John Ritchie Jr., presents a report on the mileage obtained by vehicles at an expenditure of one ($1) dollar. The expense items are grouped under four heads: (1) electricity, gasoline or feed; (2) maintenance—tires or shoeing, repairs, battery, veterinary, lubricants; (3) garage or stable, driver or helper; (4) overhead charges, including depreciation, interest and insurance.

Motive Power.	Capacity of Truck.	Distance Traveled in miles.
Gasoline		3 1/2
Horse	1000 lbs.	3 7/8
Electric		4 2/5
Gasoline		2 3/5
Horse	4000 lbs.	2.9
Electric		3 1/4
Horse		2.07
Gasoline	7000 lbs.	2.3
Electric		2.7
Horse		1.6
Gasoline	70,000 lbs.	3 7/8
Electric		2.2

The above figures were compiled on fuels at the following rates: Horse feed, $190.00 per year per head; gasoline at 16c per gal, and electricity at 3c per kw.-hr.

The first two items are constantly increasing, which will result in decrease in mileage, while the charge for current and the downward trend in the price per kw.-hr. will give greater superiority to the electric truck by a gradually increased mileage.

Again, compare if you will, the space occupied for fuel. The baled hay and oats necessary for a team of horses in the month will require one hundred cu. ft., while the gasoline, 20 cu. ft., and the energy supplied by transmission wires to the batteries—no storage space.

Again, compare the cost per mile traveled:

Power	Type	Cost per Mile.
Gasoline		27 1/2c
Horse	1000 lbs.	25 1/2c
Electric		23c
Gasoline		37 1/2c
Horse	4000 lbs.	35c
Electric		30 1/2c
Horse		46c
Gasoline	7000 lbs.	43c
Electric		36 1/2c
Horse		59 1/2c
Gasoline	10,000 lbs.	51c
Electric		45c

From a careful consideration of the above figures, it is evident that the solution of the transportation problem for all farming purposes is the general use of electric current permitting the economy to the farmer that is possible in cities by the use of the electrically propelled vehicle, and that a liberal policy of the quasi public utilities in line extension and generous demonstrations will indicate clearly that cooperation is more than a meaningless term in all problems, urban and rural.

WIRELESS CIRCLES GLOBE.

Washington, Feb. 20.—Arrangements are being made between the American and Russian governments for the establishment of a regular wireless service across Bering Sea, which will insure telegraphic communication between America and Asia at all times, even in the event of interruption of the cable service. The project, it is said, taken in connection with the existing trans-Atlantic radio service, completes the circuit of the globe by this means of communication.

TELEPHONE SERVICE CHECKS IN WISCONSIN.

BY J. N. CADBY.[1]

Herewith is a sample of the test card used by the inspectors. Whenever inspectors are examining the quality of gas or electric service in any city, they have occasion to use the telephone in calling up parties whom they desire to interview, inquiring for express or regarding the time of trains on which they may wish to depart. These incidental calls are recorded on the test card and since the inspectors are equipped with split second stop-watches they can easily give accurate data regarding the time elapsing before the operator answers and the total time required to get the party from the beginning of the call. All irregularities, such as wrong number given, poor transmission, poor supervision, objectionable noises on the line, or other irregularities in the service are noted. If these incidental calls indicate poor service, the inspector endeavors to make a number of additional calls whenever he can do so without seriously delaying his work.

Whenever the calls sent in incidentally by gas and electric inspectors indicate that further inspection should be made, the regular telephone inspector makes 50 to 100 test calls from the various sections of the city and also visits the exchange and looks over complaint records and operating data before making his report to the office. The test calls made by the inspector are plotted graphically, showing the percentage of calls answered in various intervals of time.

Aside from inspections made on account of the conditions reported by gas and electric inspectors, similar tests are made whenever formal or informal complaints reach the commission. Routine inspections of this kind are also made in the larger cities at least once each year. A report to the telephone company setting forth the findings of the inspector follows each regular inspection. If the records are unsatisfactory, a follow-up inspection is made within a reasonably short time. It has been possible by this general method to bring the telephone company officials and employes to watch more closely their quality of service. It has been the commission's desire in this grade of service, as well as in the others, to encourage self-criticism on the part of the operators and supervise in a general way the operation. No attempt is made to inspect service continually and call attention to a great number of individual cases. At the same time, however, the specific incidents are brought to the attention of the management, both by the inspector, after completing his secret test calls, and through correspondence from the office. The reason calls are made secretly is obvious, since entirely normal conditions can not prevail when the officers and employes know that an inspection is being made. The last test call made is always one making an engagement with the manager of the exchange for an interview. The manager under these conditions is able to determine which operators were occupying the various positions at the particular time of the test, the absence of certain operators and the presence of any temporary help which might be necessitated thereby.

[1]Telephone expert for the Railroad Commission of Wisconsin.

Wherever poor service has been observed, it has been possible to bring about satisfactory improvement within a reasonable time without the necessity of formal action. In case any telephone company fails to make reasonable and prompt improvement in service, formal action would probably be resorted to.

After the first year's inspections were completed, a general letter was sent to the various exchanges in the cities having over 10,000 population. This was in December, 1909. In this general letter it was stated that the average time to answer calls denoted to a fair degree the character of service. In the larger exchanges, which were included in the first year's tests, it was found that the service of the best exchanges was such that the average for 100 test calls was in the vicinity of four seconds. That 80 to 85 per cent of these calls were answered within 5 seconds and that 5 per cent were answered within 7 seconds. The time of the slowest answers did not usually exceed 12 seconds. The size of the city or the size of the exchange did not seem to affect these values very

4-20-11-2M FORM 268

JOINT ENGINEERING DEP'T WIS. TAX & R. R. COMMS.

Telephone Service Inspection

City..... Name of Co..... Date..... Insp.....

	Party Called		Time to Ans.		Time of Test	Call Made From
	Number	Name	By Cent.	By Party		
1						
2						
3						
4						
5						
6						
7						
8						

(Always call R. R. stations) (over)

Inspector's Card Used by Wisconsin Commission.

materially. It was found that where the service was prompt, the operators in general were accurate and that they frequently repeated the numbers correctly and supervised the calls very well. After business hours and on Sundays the service was somewhat slower and less regular than the above indicates. Companies have been encouraged to have operators use standard phraseology, repeat numbers accurately disconnect as promptly as possible after the conversation was completed and supervise all calls not promptly answered by the party called. Out of date directories were mentioned and where better equipment was needed or where the equipment was not kept in first class operating condition, the same was called to the company's attention.

We feel that the above plan of inspecting telephone service has considerably improved conditions throughout the State. Most of the attention up to the present time has been devoted to city exchanges, but recent complaints and investigations have shown that the rural communities are greatly in need of better service and for that reason the staff will devote considerable attention during the next year or two to the raising of the quality of telephone service in rural communities. Six gas and electric service inspectors turn in incidental inspections, and one man spends most of his time on telephone service and is able to carry on practically all the field tests not made by the gas and electric inspectors.

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The Passing of the Boiler Horsepower

The passing of the unit known as the "boiler horsepower" is indeed a significant step in the direction of simplifying engineering computation. The recent action of a joint committee representing the American Institute of Electrical engineers and the American Society of Mechanical Engineers recommending the substituting in its place of the myriawatt emphasizes two important steps accomplished in engineering evolution. In the first place a cumbersome and irrational factor is thus to be torn from engineering routine. Again, this first act of joint standardization work by the two great national engineering societies gives promise of being the forerunner for much greater simplifying effort in the near future. The many other empirical and irrational ratings and units employed might well be abolished along with the boiler horsepower, such as the complicated systems used to express the gravity of fuel oils, the conflicting definitions of the British thermal unit, and a host of others.

The new unit to be used to replace the boiler horsepower is to be known as the "myriawatt," derived from the Greek "myria," meaning ten thousand. Thus, a myriawatt is 10,000 watts, or 10 kilowatts.

In the early days of the steam engineer, before any rational basis was proposed, to give the same rating to the boiler irrespective of losses as determined from the indicated horsepower of the steam engine, became popular as a rule of the thumb. Thus, a boiler that could supply steam to operate a steam engine developing 50 indicated horsepower was said to be a fifty horsepower boiler. Later it became evident, due to the rapidly increasing efficiency of the steam engine that such a rating was wholly variable. Hence, it was determined that a boiler supplying 30 lb. of steam per hr. at 70 lb. pressure from feed water at 100 degrees F. developed an indicated horsepower in the average steam engine of the day. In the further evolution of steam engineering, pressures and temperatures became so variable and the steam engine so improved in efficiency that the A. S. M. E. Committee on Boiler Tests in 1884 defined the boiler horsepower as being equivalent to the evaporation of 34.5 lb. of water at 212 degrees F. into steam at 212 degrees F. By referring to the recent researches of Marks & Davis, defining the British thermal unit as 1/180th of the heat necessary to raise 1 pound of water from 32° F. to 212° F., it is found that each pound of water evaporating into steam at 212 degrees F. absorbs 970.4 B.t.u. of heat energy. Hence one boiler horsepower thus becomes equivalent to the absorbing of 33,479 B.t.u. of heat energy per hour.

The ordinary horsepower known throughout the world is equivalent to 2547 B.t.u. per hr. Hence the boiler horsepower is a unit 13.14 times the ordinary horsepower—wholly irrational and without any excuse for existence, save what tradition and common practice might dictate.

Due to the popularity and growing use of the steam turbine, the output of which is of necessity expressed in kilowatts in order to mate with the distributing units electrically supplied, a conflict thus arises between input and output language of expression. The

myriawatt or 10,000 watts, being equivalent to 34,150 B.t.u. per hr., offers a scientific unit for substitution, which is only 2 per cent larger than the former irrational and empirical unit known as the boiler horsepower. Although it is still to be regretted that the myriawatt does not yet make output and input expressible in like units, still a factor of ten furnishes a basis readily convertible, and makes possible a change in units without materially upsetting the old boiler horsepower range of capacity.

Golden Poppy Special No. 2

"The poppy," says the Standard Dictionary, "is a showy herb of the Old World, a few species being cultivated and sparingly naturalized in the New." As an instance of what a "showy herb" can accomplish, however, a brief reference to Oriental history will prove of interest. In 1839, the government of China being desirous of preventing the use of opium, extracted from the poppy, destroyed a great quantity of this sleep-giving drug.

The opium proved to be the property of British merchants. Hence, this destructive act led to the first war with England and ultimated in the opening of China and Japan to the commerce of the world. John Smith in his dictionary of popular names of plants properly concludes, therefore, that the poppy with tea, sugar, tobacco, and cotton plants, has been an important agent in changing the political and social condition of nations.

And, so it is that the few species of this "showy herb," which, as stated above, is being cultivated and sparingly naturalized in the New World, projected a trip to the Seattle convention of the National Electric Light Association last June, which proved so profitable, so wholesome and withal embodying so many of the underlying characteristics of any important agent which exerts its influence in changing the "political and social conditions of nations," that a second Golden Poppy Special will set forth to the Chicago convention in the latter part of May in the current year.

It is in this enlarged interpretation that tone is given the apt naming of this symbol of Western enterprise. The poppy, the state flower of California, connotes to the thinking mind the days of forty-nine and the golden opportunities of past, present and future in that great district lying west of the Rocky Mountains. It speaks for the coming days of 1915, and for the second calling of the N. E. L. A. convention to a Western port in that year of years. Above all, too, it speaks not alone of filthy money value but, as gold is most often found in nature in the pure unadulterated state and is difficult to fuse with baser metals, so the the Golden Poppy Special No. 2 would carry again to the representatives of this great gathering of national power and lighting interests, the emblem that moves nations to action and enterprise; and the golden poppy, symbolic of the pure unadulterated opportunities offered in that growing world of commercial activity—the West—will once more go forth resplendent in the enterprise and confidence of electrical opportunities on the Pacific Coast.

Again, much is to be gathered by those participating in this excursion from close commingling with our Eastern brothers at an electrical gathering of the proportions contemplated at Chicago in June. The central station executives, pursuing the broad business policy of sending a strong Western delegation to this convention, will reap their reward. New and widening viewpoints are bound to follow and absorbed ideas of Eastern competitive business methods are sure to prove of immeasureable profit when the time arrives to foot up another year's log sheet.

Checks on Telephone Service

One of the most beneficial results of the Wisconsin commission supervision, both to corporation and public alike has been the splendid telephone service there instituted. Promptness in answering calls is dependent upon many variables. In Wisconsin the railroad commission employs a telephone expert whose duty it is to make periodic tests and follow up complaints of every nature so far as they may pertain to the telephone service. The history and accomplishments of this unique institution in Wisconsin is interestingly related on another page of this issue by the man having this important work in charge.

Complaints were seemingly so broadcast throughout certain districts on the coast relative to telephone service, the editorial force of this journal has undertaken the gathering of definite data to determine the justification of such murmurings. After having secured the letter from Wisconsin, published in this issue, a number of tests were put through in and about the bay region of California agreeable to the inspector's card as published elsewhere. The average of the tests as gathered showed 8.5 seconds elapsing before a reply from central and a total of 24.4 seconds before reaching the central of the party called. In Wisconsin the service of the best exchanges is found to be four seconds. Furthermore, 80 to 85 per cent of their calls are answered within 5 seconds, and their slowest answers do not usually exceed 12 seconds. The one pleasing result of the informal tests put through in California as indicated is that a material improvement in service during the past fortnight is indicated. Still, there is yet absolutely no comparison between the results attained in California and those in Wisconsin.

That the regulating commissions in California and other Western states should institute similar inspection to that maintained in Wisconsin can no longer be questioned. The telephone authorities themselves should welcome such procedure. Indeed a prominent telephone engineer when recently discussing commission regulation before one of the western branches of the American Institute of Electrical Engineers himself spoke of the high regard in which commission telephone inspection is held by the telephone authorities in Wisconsin. He described the pride with which various operators held themselves always in readiness in order to appear high up upon the reports of the commission inspector.

Along with the intense subject of rate discussions, the regulating commissions should not overlook this function of inspection theirs by law. Minimum cost is desirable, but meanwhile every co-operative aid should be extended in order that maximum service may be rendered.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. H. Manny of the Manny-Myers Company at Seattle is visiting California.

F. N. Averill of the Fobes Supply Company at Portland, is at San Francisco.

W. H. Leffingwell, chief engineer with the Mono Power Company of Bishop, Cal., is at San Francisco.

A. L. Havens, manager of Pierson, Roebing & Co.'s Los Angeles office, was a recent visitor in San Francisco.

Jesse W. Churchill of the California-Oregon Power Company, with headquarters at Yreka was at San Francisco this week.

A. B. Saurman, Pacific Coast manager for the Standard Underground Cable Company has returned from a brief Eastern trip.

A. J. Myers, Pacific Coast manager for the Wagner Electric Company, has returned from an extended trip through the East.

M. M. O'Shaunessy, city engineer for San Francisco, is at Washington, D. C., to represent the city at the Hetch Hetchy water hearing.

Geo. A. Campbell, general manager Truckee River General Electric Company at Reno, Nevada, was at San Francisco during the past week.

Roy Worth has taken charge of the Seattle office of the American Ever Ready Company after over a year's service at the San Francisco headquarters.

R. B. Clapp of the Westinghouse Electric & Manufacturing Company of Los Angeles, and **H. W. Woodill** of the Woodill & Hulse Electric Company, are at New York.

H. B. Kirkland, general sales manager of the American Conduit Manufacturing Company of Pittsburg, Pa., and Fifth Jupiter of the Jovian Order, attended the meeting of the Pacific Coast Electrical Jobbers' Association at Del Monte this week.

Ross Hartley, Portland manager for the Pacific States Electric Company, and **F. N. Killam**, manager of the Seattle house, were in attendance at a conference of sales managers at San Francisco during the past week and later attended the jobber's meeting at Del Monte.

E. C. Bradley, vice-president and general manager of the Pacific Telephone and Telegraph Company, has announced his intention of resigning at the annual meeting of the stockholders March 5th, with a view of retiring from active life, after forty years' service. He started as a telegraph operator and in time became third vice-president of the Postal Telegraph Company. Later he was associated with the American Telephone and Telegraph Company in Boston and New York, and then came to the Pacific Telephone and Telegraph Company.

Fifty business men of San Francisco made a trip to the high Sierras Washington's Birthday under the direction of the Pacific Gas & Electric Company. The party returned full of anecdotes of its pleasant journey. For the most part the excursionists were representatives of the gas and electric appliance houses of the city and the trip was taken to show them the site of the big dam which the Pacific Gas & Electric Company is erecting at Lake Spaulding, within a few miles of Emigrant Gap. The names of the boosters' delegation were as follows:

C. C. Beattie, C. D. Steiger, J. E. Crilly, D. E. Harris, C. E. Murphy, J. H. Hunt, R. McIntyre, W. L. Neelands, E. H. Coleman, L. Fitzpatrick, E. Brandon, T. Haskins, H. Heitmuller, L. Fotreau, P. T. Sprague, D. Davis, M. Blum, G. Scheer, E. A. De Lue, K. Welbach, J. Francisco, H. Stratford, F. Leahy, F. McGovern, G. I. Williams Jr., C. Elsasser, H. Rowe, N. Ware, R. B. Swayne, H. S. Norman, W. R. Dunbar, F. Wooll, R. W. Martindale, S. Gilman, H. B. Mills, L. R. Edwards, E. G. de Wald, J. G. Reid, J. R. Thompson, T. F. Leary, D. T. Blair, C. A. Lamb, F. Pierce, G. Muir, L. A. Nott, N. E. Otterson, W. E. Mushet, George D. Monaghan, E. O. Mahoney, G. Murphy.

H. R. Noack, president and general manager of Pierson, Roeding & Co., announces that **S. K. Colby**, vice-president of the company, has also become associated with the firm of Allen & Peck Inc. of New York City, as one of the vice-presidents. Mr. Colby will retain his interests and title with Pierson, Roeding & Co., and there will be no further changes in the personnel of this well-known firm, which has come so much to the front in electrical matters on the Pacific Coast under the able direction of Mr. Noack during the past fifteen years. Since his graduation from the Renesselaer Polytechnic Institute in 1894, Mr. Colby has been actively connected with some of the largest public service corporations and electrical manufacturers in the country, particularly in connection with electric railway work. In 1895, he became engineer in charge of construction for the Troy & New England Railroad, an eight-mile electric railway project, and later became assistant to the manager of the New York office of the Pittsburg Reduction Company, which afterward became the Pittsburg Aluminum Company of America. Within less than two years he had charge of the New York office, resigning in 1905 to become treasurer, and later vice-president and half owner of the firm of Pierson, Roeding & Co., who represent a number of well-known manufacturers on the Pacific Coast, specializing in power transmission and railway equipment. These include the J. G. Brill Company, The Aluminum Company of America, the Electric Storage Battery Company, the Locke Insulator Manufacturing Company, the Fibre Conduit Company, the Lombard Governor Company, the R. D. Nuttall Company and the tower department of the American Bridge Company, thus giving him an intimate acquaintance with most of the electrical constructions in the western part of America. He has played an important part in the development of aluminum as an electric conductor, and has been closely associated with electric railway developments on the Pacific Coast. In October, 1912, he was elected a member of the Executive Committee of the American Electric Railway Manufacturers' Association, also being an associate member of the American Institute of Electrical Engineers and an associate member of the American Society of Civil Engineers.

ELECTRICAL DEVELOPMENT AND JOVIAN LEAGUE.

At a special meeting of the Electrical Development League held February 25 the amended by-laws were adopted, which completes the affiliation of the Jovian Lunch Club with the League, and the united bodies will hereafter be known as the Electrical Development and Jovian League. Mr. T. E. Bibbins was elected president; C. C. Hillis, vice-president, and E. B. Strong, secretary-treasurer, of the new organization. Messrs. Geo. C. Holberton, W. L. Goodwin, F. H. Woodward and Frank Watts, members of the Executive Committee. Judge Thos. De Bevoise of New York, counsel for the Electrical Jobbers' Association, is to address the League Monday, March 3, on the subject, "Our Competitors in Business." A record-breaking attendance is anticipated.

PACIFIC COAST CONVENTION OF AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the request of the Institute members in Vancouver and vicinity, the Board of Directors has authorized the holding of the annual Pacific Coast Convention of the A. I. E. E. at Vancouver, British Columbia, on September 9, 10 and 11, 1913. The Vancouver Section has been working for some time in preparation for this convention, and has already arranged for a number of papers, and plans are maturing for interesting trips to some of the large hydroelectric installations in the vicinity of Vancouver. Arrangements are being made for special rates over all railroads, and as this will afford to the engineering fraternity an excellent opportunity for visiting this region so interesting from the point of view of hydroelectric development, it is expected that a large attendance from the East, as well as from the West, will be assured.

A. I. E. E. LECTURES ON RADIOACTIVITY.

It has been found necessary to change the dates for the series of lectures on "Radioactivity" to be given by Professor Edwin P. Adams of the Palmer Physical Laboratory of Princeton University, under the auspices of the Electrophysics Committee of the Institute, of which preliminary announcement was made in a previous issue. The lectures will be given at 8:15 p. m. on Wednesday evenings, March 19 and 26, and April 2 and 9, in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth street, New York.

Following is an outline of the topics to be treated in the four lectures:

Lecture I—March 19.

The discovery of the property of radioactivity.
Radium and its preparation.
Ionization of gases.
Nature of the radiations from radioactive substances,—alpha, beta and gamma rays.

Lecture II—March 26.

The disintegration theory of radioactivity.
The distribution of radioactive substances.
Radium and the age of the earth.

Lecture III—April 2.

Dependence of the mass of an electron on its velocity.
The electron theory of matter.
Electrons in optical theory. Zeeman effect.
Emission and absorption of light.

Lecture IV—April 9.

Metallic conduction.
Indication afforded by the study of radioactivity regarding the structure of the atom.
Optical phenomena in moving bodies.
The principle of relativity.

The lectures will be open to the membership of the Institute. The members of the American Society of Mechanical Engineers, The American Society of Civil Engineers, The Electrochemical Society, and the Illuminating Engineering Society have also been invited.

Oregon Technical Club.

The last luncheon to be held at the Portland Hotel took place on Tuesday, February 18th. The luncheons in the future will be held at the Commercial Club. J. H. Morton was chairman of the day and D. C. Henny, consulting engineer for the Reclamation Service in the Northwest, was the speaker. He made an able address on "Points That Controlled Irrigation in the West.". "People are impatient with the delays in big enterprises; they expect immediate results," said Mr. Henny. "They also fail to see that there is a growing cost an acre as the more difficult tracts are watered. A survey of the whole movement leads us to trust that the inherent difficulties of reclamation will be understood better as time passes, and that the essential principles by which Federal, state and community work may be secured will not be put aside without a careful study of the history of irrigation procedure."

W. D. Scott of the Pacific Telephone & Telegraph Company will be chairman of the next luncheon and W. J. Phillips will be the speaker. His subject will be "Moulding Public Opinion Along Engineering Lines."

San Francisco Engineers' Club to Be in Permanent Quarters.

On last Tuesday noon at the Palace Hotel in San Francisco, the Engineers' Club unanimously voted to acquire permanent quarters, for the present at least, in the Balboa building. The club will be served by the Hoffman Cafe. It is now believed that this act will ensure a rapid and elivening growth in the organization and within a year that more substantial quarters may be secured. The quarters decided upon are certainly centrally located and all present were enthusiastic over the final decided step that was taken.

Portland Jovian Luncheon Club.

The regular Thursday luncheon was held at the Oregon Hotel on February 20th. Mr. G. L. Priest was the chairman of the day and the speaker was W. C. Deitchall, on the subject of "Co-operation in the Contracting Business." Mr. Dietchall represents the Northwestern Trust Company, as superintendent of construction and pointed out the fact that architecture was on a firm footing but that the contracting business in all lines, and the owners, were always made the "goats."

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The board of directors of the American Institute of Electrical Engineers held its regular monthly meeting at Institute headquarters on Friday, February 14, 1913, at 3:30 p. m.

The Meetings and Papers Committee submitted a list of places suitable for holding the annual convention for 1913. The board voted unanimously to hold the annual convention in Cooperstown, N. Y., during the week beginning Monday, June 23, 1913.

The board authorized a two-day Institute meeting in Pittsburgh, Pa., during the latter part of April, under the auspices of the Committee on the Use of Electricity in Mines, in cooperation with the Pittsburgh Section. The exact date of the meeting was left to the discretion of the Meetings and Papers Committee, and will be announced later.

In view of the unusual activity incidental to the holding of the Midwinter Convention in New York, February 26-28, 1913, and the lectures on radioactivity to be given under the auspices of the Institute's Electrophysics Committee on Wednesday evenings, March 19th and 26th, and April 2d and 9th, it was voted to omit the April New York meeting, so that the regular meeting scheduled for Friday, April 11th, will not be held.

The lectures on radioactivity had previously been announced for Tuesday evenings during the latter part of March and April, but upon recommendation of the Meetings and Papers and Electrophysics Committees, the dates were changed to Wednesday evenings, March 19, 26, and April 2 and 9.

One hundred and one Associates were elected and eighty students were ordered enrolled.

One hundred and fifteen Associates and eighty-two Members were transferred to the grades of Member and Fellow respectively.

Upon the recommendation of the Sections Committee, the organization of a Section was authorized at Spokane, Wash., in response to a petition signed by twenty-five Members and Associates residing in that territory.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

STANDARD SPECIFICATIONS FOR WIRING BUILDINGS.

(Continued.)

Example No. 1. (For conduit work in a store and office or hotel building in the underground district, having marble main switchboard, and both master meters and check meters).

Service:

The Portland Railway, Light & Power Company will bring 120-240 volt direct current lead covered service cables into the basement at the point shown on plans, and furnish and install a service switch and cutout.

From this point the wiring contractor is to run three conductors for the entire service to the master meter-board, and do the necessary wiring on same as required and specified by the Portland Railway, Light & Power Company.

From the master meter-board the contractor is to run three conductors for the entire lighting service to the main lighting switch and cutout on the main switchboard.

From the master meter-board the contractor is to run two conductors for the entire power service to the main power switch and cutout on the main switchboard.

Main Switchboard:

In the basement, at the point shown on plans, a main switchboard is to be furnished and installed bearing metal name plate of electrical contractor, and consisting of the necessary panels of marble or slate, free from mineral veins or any other imperfections that would render it undesirable electrically, and supported on an angle iron frame.

The board is to be placed at least three feet from the wall so as to provide working space for testers and other workmen.

On the rear of the board the necessary bus bars are to be provided; said bus bars to be furnished with substantial supports, well insulated.

On the face of the board the switches, cutouts, etc., enumerated below are to be furnished and installed; no switch to have a capacity of less than twenty-five amperes.

(a) One main line 3-pole knife switch and enclosed fuse cutout for the whole lighting system.

(b) One main line 2-pole knife switch and enclosed fuse cutout and meter for the 240 volt power service.

(c) six 3-pole knife switches and enclosed fuse cutouts and meters, one for each of the six feeders to the stores.

(d) Six 3-pole knife switches and enclosed fuse cutouts and meters, one for each of the sign feeders for each of the six stores.

(e) One 3-pole knife switch and enclosed fuse cutout and meter for the feeder that is to carry the second, third and fourth floors.

(f) One 3-pole knife switch and enclosed fuse cutout and meter for the feeder that is to carry the fifth, sixth, seventh and eighth floors.

All switches to be of approved make and to be provided with a suitable name plate indicating service controlled by it.

The switchboard is to be fitted with two suitable bracket lamps with shades so arranged as to illuminate the dials of the meters.

The contractor is to furnish all the necessary fuses for this board and one extra set for each cutout. All fuses are to be of the enclosed type new code fuses, either "Noark" or "D. & W." or equal.

Meters:

Standard General Electric Company's recording wattmeters arranged for side connection will be furnished and installed by the Portland Railway, Light & Power Company. The wiring contractor, however, is to provide space for the check meters and is to furnish and install the necessary meter board on the back of the switchboard for these meters, and to furnish and install all the necessary connections for same; said connections to be taken off mains behind individual feeder switch and cutout.

Lighting Feeders:

From the meter on the main switchboard 3 conductor feeders are to be run as follows:

(a) One to the branch cutout cabinet in each of the six stores.

(b) One of No. 10 rubber covered wire for each of the six sign services above mentioned, to the switches located under the windows in the entrances of the above mentioned stores, and from here to a point over the entrance, and sufficient wire left extending for future connections to signs.

(c) One to the branch cutout cabinets on the second, third and fourth floors.

(d) One to the branch cutout cabinets on the fifth, sixth, seventh and eighth floors.

Power Feeders:

From the meter on the main switchboard a feeder is to be run to the various elevator and ventilating system motors as follows:

(a) Three 20 h.p. elevator motors at the foot of the elevator shaft in basement.

(b) One h.p. ventilating system motor in room for same in basement, as shown on plans.

(c) One 5 h.p. ventilating system motor in the south wing of the fifth floor, at the point shown on plans.

(d) One 2 h.p. ventilating system motor in kitchen on the eighth floor, at the point shown on plans.

These feeders are to be run to the points indicated and terminated in switch cabinets consisting of No. 12 sheet steel, thoroughly stiffened with angle iron, and furnished with doors made up of No. 10 sheet steel, fitted with suitable spring latches, and hinged at the top so that same will be self closing. In these cabinets are to be mounted proper switches and cutouts and provision made for future connection of motor leads.

Cutout Cabinets:

On each and every floor, from the first to the top floors, (both inclusive) and at positions shown on plans, cutout cabinets are to be furnished and installed, the frames of which are to be made up of No. 14 sheet steel, thoroughly stiffened with angle iron, and furnished with doors made up of No. 12 sheet steel, fitted with suitable spring latches, and hinged at the top so that same will be self-closing. In these cabinets are to be mounted standard fuse plug cabinet panels furnished with the necessary linings. Those panels are to be made up of highly polished black enameled slate, free from metallic veins or other faults, and having mounted thereon all the necessary copper bus bars to feed the various circuits, and arranged for 3-wire mains and 2-wire branch circuits. Each panel is to be fitted with a main switch and enclosed fuse cutout.

The contractor is to furnish all necessary fuses for all panel boards, main line fuses being of the enclosed cartridge type and the branch fuses of the Edison plug type. An extra set of fuses for each of the cabinets is to be furnished by the contractor.

In all the cabinets furnish connections for two circuits in addition to present requirements, same being for future use.

Each circuit is to be numbered in some permanent manner, and a neat schedule showing the number or name of the rooms or outlets to which the various circuits run is to be furnished on the inside of the door of each cabinet, being held in place by means of a suitable frame. After the cabi-

nets are set up and all connections made they are to be thoroughly cleaned out and painted with an approved black paint.

Branch Circuits:

From the cutout cabinets necessary branch circuits are to be run to feed the various outlets as shown on plans.

Curved lines shown on plans connecting outlets indicate that connected outlets are to be on the same circuit. Where no such connection lines are shown, contractor may wire for such outlets in the most practical manner.

From the branch cutout cabinet on the second floor the necessary branch circuits are to be run to the outlets for lamps in the main entrance on the first floor and the outlets in the building or common basement.

From the branch cutout cabinet in each of the .... stores the necessary branch circuit or circuits are to be run to the outlets, as shown on plans, in the basement under each of the ..... stores.

Note:—If the desired location of these outlets is not known, clause (51) can be written as follows: From the branch cutout cabinets in each of the ..... stores, two (or more) branch circuits are to be run down into the basement for future extension, sufficient wire being left hanging below the ceiling to provide easy connection.

All hall lights are to be on separate circuits from those in the rooms.

The branch circuits to the window and entrance lights and signs are to be run to switches located under the windows in the entrances to the various stores. The window circuits are to be run from these switches eight feet up the window casing, and sufficient wire left extending to provide connection for future window lamps. The circuits for the entrance lamps are to be run from their switches to the outlets in the entrances.

Switches:

All circuits and outlets not mentioned below are to be controlled by the double pole knife switches in cutout cabinets.

All ceiling outlets connected by curved lines to switch outlets which are indicated thus ("S") on plans, are to be controlled by flush push button switches with face plates to match other hardware.

Window circuits, entrance circuits and sign feeders in stores are to be controlled by flush rotary snap switches placed in the panels under windows in entrances, the switches to be provided with locking attachments with keys for same in order that such circuits may be controlled from the exterior of the building.

One of the store basement circuits in each of the stores is to be controlled by a rotary snap switch placed on the wall at the head of the stairs.

The lamps in the common basement near the foot of the basement stairs are to be controlled by a rotary snap switch placed just inside of the door leading to the basement from the main entrance.

The lamp in the main entrance is to be controlled by a rotary snap switch placed beside the last mentioned switch.

All ceiling outlets in the rooms on the second floor and above are to be controlled by flush push button snap switches located as shown on plans, with face plates to match other hardware.

(To be continued.)

ELECTRICAL ORDINANCES IN SMALL OREGON CITIES.

Electrical ordinances have been recently passed by the cities of Medford, Grants Pass, Ashland and Hillsboro, Oregon. The great difficulty experienced in small cities is to find some one who is capable of holding the position of inspector in an intelligent and efficient manner.

The following is the form of ordinance which has been used in the above cities:

Section 1.—It shall be unlawful for any person, or persons, firm or corporation to introduce any electric lighting, heating, or power wire, circuit or circuits, apparatus in or on any building, or awning, structure or addition thereof, within the corporate limits of the city of.....unless the same shall be in conformity with the rules and regulations set forth in what is known as the National Electrical Code, being rules and requirements for the installation of electrical wiring and apparatus for electric light, heat and power, as the same are now established, together with any amendments and changes made from time to time, are hereby adopted and approved. Before any such electric wiring shall be commenced in or on any building, awning, structure or addition thereto, a written permit must be obtained from the ....of said city, authorizing the person or persons, firm or corporation, therein named to do and perform the said electric wiring, and designate the location where the same is to be performed. No such electric wiring shall be commenced as aforesaid, until said permit has been obtained.

Section 2.—After any electric wiring shall have been completed in or on any building, awning, structure or additions thereto, for which a permit has been issued, the person or persons, firm or corporation who performed the same must immediately notify ..... of the completion of the work, and must keep said work open for inspection by and until he shall have examined and approved the same, and issued a certificate of such inspection. It shall be the duty of the ..... upon receiving said notice to inspect said electric wiring, and if the same has been performed in accordance with the rules and regulations as set forth in the National Electrical Code, as herein and before mentioned, he must issue a certificate to such effect, and deliver the same to the person or persons, firm or corporation having done said wiring, but if not performed in accordance with the said rules and requirements, he shall withhold such certificate until all defects are remedied.

Section 3.—..... shall have the rights to enter into all buildings where electric current wire exists for the purpose of inspecting the same.

Section 4.—The said ..... is hereby empowered to inspect or reinspect all wiring in or on buildings and apparatus conducting electric current for light, heat and power, and when said conductors or apparatus are found to be unsafe to life and property he shall notify the person, or persons, firm or corporation, using or operating them to place the same in a safe and secure condition within forty-eight (48) hours. Any person or corporation failing or refusing to repair, change or remove same within forty-eight (48) hours, or within such further time as the ..... deems necessary, after receipt of such notice, shall be subject to the penalty hereinafter provided.

Section 5.—All installations, changes, alterations, extensions, or repairs to existing electric installations made previous to the adoption of this ordinance, shall be done in accordance with the hereinbefore mentioned rules of the said National Electrical Code.

Section 6.—Any person, or persons, firm or corporation, who shall violate any of the provisions of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof before the city recorder shall be punished by a fine of not exceeding fifty dollars ($50) or by imprisonment in the city jail of Oregon, not exceeding twenty-five days, or both fine and imprisonment.

Section 7.—All ordinances or parts of ordinances in conflict herewith are hereby repealed.

NEWS OF THE ELECTRICAL CONTRACTORS.

The W. H. Smith Electrical Engineering Company, 1003 Spalding building, Portland, has been incorporated by W. H. Smith and associates. The company is now in a position to undertake the installation of electrical machinery, the building of power plants and the electrical equipment of buildings. The contract for doing the wiring and installing electric motors in the University Club building, Portland, has been awarded this company.

The Oregon Hotel annex at Portland, has installed an isolated plant equipped with three 100 kw., Allis-Chalmers Company 3-wire generators, 120-240 volts, directly connected to three Skinner engines; the switchboard being furnished by the Allis-Chalmers Company also. The boilers were furnished by John Brennon & Company, Detroit, Michigan. The installation work was done by the H. M. H. Electric Company

of Portland, Oregon. The electrical installation in the rest of the building was installed by the Pacific Fire Extinguisher Company. The switchboard was furnished by the A. G. Electric Manufacturing Company, Seattle, Wash., for the building proper.

The Multnomah Hotel at Portland has installed one unit of an isolated plant, consisting of one 75 kw. Crocker-Wheeler Company's 3-wire d.c. generator, 120-240 volts, directly connected to a Ball Engine Company's compound engine. This installation was installed by the Pacific Electric Engineering Company, just before they went into the hands of a receiver.

The plant in the new Multnomah county court house is composed of the following 1-75 kw. Crocker-Wheeler Company's d.c. 3-wire generator, 120-240 volts, directly connected to a 12 x 16 Pheonix Iron Works Company's simple engine, located in Meadville, Pa.; 2-150 kw. Crocker-Wheeler Company's d.c. 3-wire generator, 120-240 volts, directly connected to Pheonix Iron Works Company's tandem compound engines, 13 x 16 and 22½ x 16. The plant is also equipped with Scotch marine boilers, built by the Pennsylvania Steel Company, and equipped for oil burning. The switchboard was built by the H. G. Electric Manufacturing Company, Seattle, Wash. This electrical installation, as well as the last half of the building electrical installation, was installed by the Pacific Fire Extinguisher Company.

The electrical contract for the Portland city jail has been awarded by the executive board of the city council to W. L. Bradley & Company, of Portland, Oregon, for the amount of $11,245.

McMEEN & MILLER INCORPORATED.

The well-known engineering firm of McMeen & Miller, which for the past ten years has existed as a partnership between Samuel G. McMeen and Kempster B. Miller, has been incorporated under the same name. The personnel of the new firm includes Mr. McMeen and Mr. Miller, the former partners, and as a new member Mr. Leigh S. Keith, who for a number of years has been connected with the firm in the capacity of managing engineer.

The incorporation of this firm comes as the result of its constantly widening field of operations. The old partnership was established, primarily, to conduct a general telephone engineering and patent expert practice. Mr. McMeen and Mr. Miller were the first engineers to establish themselves in a general telephone engineering business, detached from all manufacturing and operating concerns. The scope of the concern has rapidly widened, so that the greater bulk of the work of the firm for a number of years has been in the line of consultation, design, construction and management in connection with properties in the railway, light and power fields, and investigations of public service corporations for private and municipal interests.

Mr. McMeen, who is the senior member and vice-president of the new firm, is well known as one of the pioneer telephone men of the country, having served the Central Union Telephone Company in all capacities from operator to chief engineer. Later he had wide manufacturing experience with the Western Electric Company, and since entering into partnership with Mr. Miller, has become well known as a designer and constructor, and as an executive of public service corporations. Among the more recent notable work done by Mr. McMeen might be mentioned the engineering, construction and subsequent executive management of the San Francisco Home Telephone Company, and his services as president of the Mount Hood Railway and Power Company, of Portland, Oregon, during the later stages of its plant construction and previous to its consolidation with the Portland Railway, Light and Power Company.

He is at present located at Columbus, Ohio, where he is devoting practically his entire attention to the affairs of E. W. Clark & Co., of Philadelphia. He is president of the Columbus Railway and Light Company, one of the Clark properties, and has the executive management of all of the allied electric properties in Columbus. He also serves in an advisory capacity in the Clark properties throughout the country.

Mr. Miller, who is president of the new firm, is perhaps best known to the world as the author of "American Telephone Practice," for many years considered the standard treatise on telephony the world over. Mr. Miller, after graduating from Cornell, served a short apprenticeship in the lighting and power departments of the Thomson-Houston and Westinghouse factories, then entered the telephone manufacturing field in Chicago, and for many years was identified, as engineer and manager, with the Kellogg Switchboard and Supply Company. Since entering the field of general consulting engineering, his talents have been directed to a wide variety of works, some of them of notable importance. He has devoted much of his attention to special investigations of public utilities, both from the engineering and financial standpoints. He is general manager of the Central Oregon Power Company and is at present devoting much attention to the development of hydroelectric projects on the Deschutes River, in Oregon. He is also acting as consulting engineer on special problems for a number of electric railway, light and power companies, particularly specializing, in this connection, on the subject of electrolysis of underground structures.

Mr. Leigh S. Keith, the secretary-treasurer of the new firm, is a graduate of Massachusetts Institute of Technology. For a number of years after graduating he was employed in the engineering department of the New York Telephone Company, the later years of this service being spent in the making of special investigations directly under the chief engineer. About four years ago he entered the employ of McMeen & Miller, and has been engaged in a wide variety of engineering work particularly relating to public service investigations of light, power and telephone properties, and various special problems in the field of electric railway work, such as the location of substations, the design of feeder systems and the prevention of electrolysis. For the past three years he has been managing engineer of the firm, so that in becoming one of the principals the change involved is more of name than a function.

The organization of the company has been increased so as to include a full corps of experienced engineers fitted in every way to handle properly, not only the general work of a consulting engineering business, but also the more specialized details of economical and efficient design and construction of steam or hydroelectric stations, high-tension transmission lines and overhead and underground distribution systems.

NEW CATALOGUES.

An attractive bulletin, in colors, recently issued by the General Electric Company, is devoted to the subject of Edison Mazda Sign Lamps. The number of the bulletin is A4072, Bulletin No. A4081 is devoted to the subject of Reversing Motors for Planers, Slotters, etc. Bulletin A4083 is devoted to the subject of US-13 Roller Bearing Trolley Bases, and supersedes the company's previous bulletin of this subject. Bulletin No. 4085 describes more or less briefly that company's Battery-Charging Motor-Generator Sets for Railway Signaling. Bulletin No. A4086 is devoted to the subject of Circuit Breakers for Railway Service, Type MR. Bulletin A4070 illustrates and describes that company's Electrically Operated Remote Control Switch, Type R, Form C2, which is adapted for use wherever control from a central point is desired. It is made for both alternating and direct current.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—The Chemical Electric Light & Power Company, $1,000,000, shares $1 each, subscribed $5, by T. L. Croon, C. H. Hogg, J. B. McKenzie, L. A. Boyer, E. M. Hogg.

LOS ANGELES, CAL.—Fair View Farms Water Company, capital stock $50,000; stock already subscribed, $175; G. R. Horton, R. P. Jennings, V. E. Rising, R. L. Hanley and C. L. Haskell, directors.

LOS ANGELES, CAL.—Inyo County Water & Power Company; capital stock $200,000; stock already subscribed, $43; Louis Luckel, James MacLachlan, L. A. Cronk, G. R. Pendell, J. E. Pettijohn and E. T. Lyon, directors.

ASTORIA, ORE.—The Mountain Springs Water Company has been formed by H. G. Thorson, W. A. Currio, W. F. White, of Portland and H. E. Christenson of Seaview, Wash., with a capital stock of $40,000, for the purpose of supplying the towns of Long Beach and Seaview, Washington, with water.

WINNEMUCCA, NEV.—The Nenzel Electric Company has been incorporated with a capital stock of 2500 shares, of a par value of $100 each, with Jos. F. Nenzel, J. T. Sullivan, J. H. Causten and J. Berger as the incorporators. The principal place of business is designated as the Big Meadow Hotel, Lovelock. It is understood that the company will at once begin work on a large power plant at Oreana, which will furnish power for Rochester.

GRANTS PASS, ORE—The Rogue River Public Service Corporation has been incorporated by Geo. Sanders, president; F. M. Fauvre, vice-president; Ovando C. Beebe, treasurer; R. E. Gaut, consulting engineer, and G. W. Soranson, secretary, with principal place of business in Grants Pass, for manufacturing hydroelectric power and providing water for domestic and irrigation purposes. It is said the company will take over the ditches and dams of the old irrigation company and will soon be in a position to assure to Rogue River valley an adequate water supply.

ILLUMINATION.

SANTA ANA, CAL.—The Southern Counties Gas Company will spend about $10,000 on a new gas system in Garden Grove.

VAN NUYS, CAL.—The Pacific Underground Construction Company has a large force of men at work putting in an ornamental light system. The posts will carry 5 clusters each, and are spaced 150 ft. apart.

RIVERSIDE, CAL.—District Manager F. A. Worthley of the Southern Sierras Power Company, estimates that $10,000 will be expended on the corporation's prospective improvements and extensions at Elsinore.

LOS ANGELES, CAL.—The board of public works has awarded the contract for furnishing and installing 398 ornamental lighting posts in Seventh street, from Los Angeles River to Hoover street to the Llewellyn Iron Works, for $24,997.60. The board ordered bids advertised for furnishing current.

TRANSMISSION.

NORTH YAKIMA, WASH.—Supervising Engineer C. H. Swigart, of the Reclamation Service, has received authority for the expenditure of $600,000 in the development of Lake Keechelus as a storage reservoir during 1913.

BAKERSFIELD, CAL.—The board of supervisors has passed an ordinance granting to the Southern Sierras Power Company a franchise to erect and operate an electric pole tower and wire system for a period of 50 years in the county of Kern.

BAKERSFIELD, CAL.—The board of supervisors has passed an ordinance granting a franchise to the Pacific Light & Power Company to construct and operate for a period of 50 years electric transmission wires across certain public highways in the county of Kern.

FRESNO, CAL.—The supervisors granted the application of the Pacific Light & Power Company to put up for sale to the highest bidder 50-year franchises for electric transmission and telephone lines from Big Creek across the county public highways. Bids have been called to be opened March 22d.

SAN FRANCISCO, CAL.—Bids were received for the construction of an electrical conduit system in the concessions district of the exposition as follows: Gorrill Bros., $11,070; Williams & Finnigan, $9300; Contra Costa Construction Company, $11,700; Michael Murphy, $14,800; Pringle, Dunn & Company, $12,816; Jas. H. O'Brien, $8460; Pierson-Roeding Company, $9477; Phillip Schuyler, $12,331.

BELLINGHAM, WASH.—The two projects planned by the Skagit power Company, taken over by the Stone & Webster people, are estimated to provide 110,000 horsepower, and Engineer Freeman states that this may be increased at need to 250,000 horsepower. Mr. Furth stated that the Stone & Webster plans call for the development of between 100,000 and 200,000 horsepower. The larger of the two plants planned by the Skagit Power Company calls for a tunnel five miles in length.

GREENVILLE, CAL.—Bond buyers of San Francisco recently sent experts into the North Fork country, near Seneca, to investigate the Indian Valley Light & Power Company project. C. H. Miller, a hydroelectric engineer of San Francisco, has completed an investigation of the water supply and sites, and has left for Quincy on his way to make his report. The project, he declares, will be backed by his people and operations started at once to develop a first unit of 1000 h.p. for the local field. Other units will be added as the field broadens and the ultimate of 3000 h.p. is reached.

TACOMA, WASH.—Advocating that the municipal electric power plants of Tacoma and Seattle be joined, Superintendent J. D. Ross, of the Seattle power plant, recently conferred with the local council. At the conclusion of the meeting the commissioners decided to consider the matter of a connecting line at an early session. Superintendent Ross estimated the cost at $100,000. He said that thousands of dollars' worth of business could be had with the towns along the route of the proposed pole line. About a year would be required in building the line, and the business along it should be equally divided between the two cities, Mr. Ross said.

OAKLAND, CAL.—Superior Judge J. D. Murphey, sitting in Judge Wells' department of the Superior Court, has begun the rehearing of a suit of the city of Los Angeles against the Silver Lake Power & Irrigation Company. The suit was begun in Los Angeles several months ago before Judge Murphey, but was not completed. Los Angeles attorneys are appearing in the case. The city of Los Angeles is suing to enjoin the power concern from constructing a large dam across the Owen River. The property in dispute is in the southern end of Mono county and Los Angeles lays claim to title for the land through patents of the U. S. government.

TRANSPORTATION.

TACOMA, WASH.—City Engineer W. C. Raleigh's new estimate on a car line across tideflats, without furnishing cars, is $30,000.

VANCOUVER, B. C.—A contract has been let for the construction of the subway at the exposition grounds to Mackenzie, Broadfoot & Johnson. Figured cost, $3800.

PORTLAND, ORE.—The city council has granted the Seventh street franchise to the Portland Railway, Light & Power Company. About eight miles of track will be laid and $300,000 expended.

LEWISTON, IDAHO.—The county commissioners have granted a franchisee to F. L. Strum, Lewiston, for an electric railway from Lewiston via Clarkston to Asotin. The line will be 10 miles long and cost about $300,000, to be completed within 18 months.

SAN FRANCISCO, CAL.—No bids were received for the purchase of $120,000 of bonds for the Market street extension of the Geary-street road. Supervisor Jennings introduced a resolution authorizing the city treasurer to attempt to sell those 120 bonds over the counter at par, which was passed to print.

SAN FRANCISCO, CAL.—The South San Francisco Railroad & Power Company has made application to the board of trustees for a franchise to erect and operate a double track, standard gauge railroad in the city of South San Francisco. Sealed bids will be received up to April 7, 1913, for the sale of the franchise to the highest bidder.

SAN FRANCISCO, CAL.—The annual stockholders' meeting of the San Francisco Electric Railways, which owns the Parkside electric railway and the Visitacion Valley electric railroad, was held Monday, and the outgoing board and existing officers were re-elected as follows: Lewis F. Byington, president; John A. Tyrrell, vice-president; John F. Forbes, treasurer; Geo. K. Ford, secretary, and Fred V. Statt.

MARTINEZ, CAL.—A permit to construct an electric line along the county road from Walnut Creek to Danville, and from the latter point through Green, Sycamore and San Ramon Valleys to the Alameda county line has been granted by the Board of Supervisors to the San Ramon Valley Railroad, a subsidiary corporation to the Oakland & Antioch Railway. Work must be completed on the lines within two years.

RED BLUFF, CAL.—E. L. Sisson, secretary of the Sacramento Valley Electric Railroad Company, says that his company expects to begin construction August 1 and hopes to be running trains into San Francisco over the Oakland & Antioch system within the year following. The project contemplates the building of an electric line from Red Bluff to connect with the Oakland & Antoch several miles west of Sacramento. This section will have 160 miles, and the first work will be on this end. It is the plan to build ultimately to Eureka, 160 miles more.

SAN JOSE, CAL.—That the capital necessary for building the San Jose Terminal Railroad which will connect San Jose with its newly acquired port on the south bay will be furnished by an English syndicate, is the announcement of A. S. Appleton, who has just returned from New York. The building of the road will begin within 60 days and will be completed in an unusually short time, owing to the fact that the grading over the ten miles of the line is practically completed. The new electric line will operate in conjunction with a line of barges to San Francisco. Gasoline tugs will be used for towing and automobile trucks, which will call on individual shippers and consignees, both in San Francisco and the country surrounding San Jose, will be shipped without unloading to make deliveries at either terminal and to collect new loads.

SAN FRANCISCO, CAL.—By a unanimous vote the Supervisors adopted the resolution which officially paves the way for the building of municipal street car lines to the Exposition. The resolution puts the Board of Public Works at the task of working out the scheme "to furnish to the Panama-Pacific Exposition a fully equipped municipal system of street railway service." If the final plan meets with the sanction of the supervisors it will remain for the people to say in a bond election whether they want street railways owned and operated by themselves out Van Ness avenue, Stockton street and on Union street. City Engineer O'Shaughnessy has said that the report of the Board of Public Works can be submitted within a month. On that report the ordinance will be drawn calling for a bond issue. An appropriation of $2000 to the Works board for making car plans was passed to print by the supervisors.

WOODLAND, CAL.—That the Northern Electric Company is to complete a network of lines in the Sacramento valley and give quick service between all the more important cities and towns is the information that comes to light through amended articles of incorporation. The projects include 349 miles of new tracks, uniting all towns of the Sacramento valley with San Francisco. The lines from Vallejo to Sacramento and Woodland had already been well outlined, but including important cities of Yolo, Solano, Colusa, Yuba and Butte counties is news. According to the articles, the work to begin this year includes: Sacramento through Woodland, Arbuckle and Colusa to Hamilton City; Chico to Red Bluff and Redding; Vallejo through Napa, Cordelia, Fairfield, Cement, Davis and Broderick to Sacramento, Fairfield to Suisun, a branch line; Suisun through Vacaville and Winters to Woodland; Davis to Woodland; from the main Vallejo-Sacramento line, a branch to Dixon, and from Sacramento to Folsom, from Colusa to Yuba City.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—Under the new telephone ordinance which will probably go into effect July 1, $300,000 is the estimated saving to the 'phone users of this city, while still allowing the company a return of 6.1 per cent on its invested capital. Under the present rates the company gets 8.9 per cent. If the proposed ordinance is passed with the rates as now outlined the greatest total reduction on business measured one-party lines will be those on which the present rate is $4.50 monthly. This reduction will amount to $21.72 annually on each installation, or a percentage reduction of 28.6 per cent. There is to be no change in the residence phones, the flat rate with unlimited service remaining the same. The total net earnings of the telephone company for the past year were $876,568.61 on the basis of the investment figures. The statement shows a net earning of $479,122.21. The proposed rates provide a possible leeway for an immediate adjustment of rates amounting to approximately $300,000. This leeway is enough so that the company can meet reasonable demands for increased pay on the part of its employes.

SEATTLE, WASH.—Investigation of telephone companies on the Pacific Coast, begun in this city Feb. 21, by a Federal grand jury under direction of Attorney-General Wickersham, will be absolutely impartial and will cover the entire coast. Employes of the Pacific Telephone & Telegraph Company will be examined by the inquisitors just as freely as officers of the independent lines. The only desire of the government will be to arrive at the exact truth concerning the numerous mergers and alleged violations of the Sherman anti-trust law. Such was the statement made by United States Attorney Beverly W. Coiner, following a prolonged conference between himself, Special Assistant John McCourt, Special Agent Charles Pray, of the Department of Justice, and C. J. Pettys, assistant secretary and treasurer of the Pacific Telephone & Telegraph Company, of San Francisco. Pettys, in response to a subpena duces tecum, laid before the investigators his books and records dealing with the mergers of the Bell lines with independent systems. A significant feature of the probe was the fact that none of the general officers of the Bell lines have been called as a witness before the grand jury. The same is true of the general officers of the Pacific or Sunset lines.